

Patent claims:

- claim 1
1. Method for controlling sample introduction in microcolumn separation techniques, in especially in capillary electrophoresis (CE), wherein an electrolyte buffer and a more or less concentrated sample are transported through a system of capillary channels, and wherein said sample consisting of components having different electrophoretic mobilities is injected as a sample plug into a sampling device, which comprises at least a channel for the electrolyte buffer and a supply and drain channel for said sample, said electrolyte channel and said supply and drain channels for said sample intersecting each other, and said supply and drain channels each being inclined to said electrolyte channel and discharging into it at respective supply and drain ports, wherein a distance between said supply port and said drain port geometrically defining a sample volume, characterized in that the injection of said sample plug into said electrolyte channel is accomplished electrokinetically by applying an electric field across said supply and drain channels for a time period which is at least long enough, that a slowest of said sample components having the lowest electrophoretic mobility is contained within said geometrically defined volume.
2. Method according to claim 1, wherein said time period corresponds at least to the time defined by the equation $t_{\min} = d/(\mu_i \cdot E)$, wherein d stands for the distance between said supply and drain ports, μ_i is the total electro-kinetic mobility of said slowest component, and E stands for the electric field strength across said source and drain channels.
3. Method according to claim 1 or 2, wherein said electrolyte buffer and said sample are transported electrokinetically, and further wherein immediately after said injection of said sample plug said electrolyte buffer is allowed to advance into said supply channel and into said drain channel at said respective supply and drain ports for a time period, which amounts to at least a migration time of a slowest component within said sample plug from the supply port to a detector, thus pushing back said sample into said respective supply and drain channels and substantially preventing said sample from uncontrollably diffusing into said electrolyte buffer which is transported past said supply and drain ports.

4. Method according to claim 3, wherein within said time period said sample in said supply and drain channels is subjected to an electric potential, which is different from an electric potential at a reservoir for said electrolyte buffer, thus establishing a potential difference such, that said electrolyte buffer is allowed to advance into said supply channel and into said drain channel.

5. Method according to claim 4, wherein said potential difference is chosen such, that a resultant electric field strength amounts to at least about 0.1 V/cm.

6. Method according to claim 3, wherein said electrolyte buffer is allowed to advance into said supply and drain channels by reducing a resistance to flow within said supply and drain channels.

7. Method according to claim 6, wherein said resistance to flow is reduced by either reducing the lengths of said supply and drain channels or by increasing their respective widths.

8. Method according to claim 7, wherein said resistance to flow of said supply and drain channels is reduced by providing said supply and drain channels each with a width that is at least about two times greater than a width of said supply and drain ports.

9. Method according to claim 8, wherein said supply and drain ports of said respective supply and drain channels have a longitudinal extension which corresponds at least to about said widths of said supply and drain ports, and that said widths are kept about constant along the extension of said supply and drain ports.

10. Method according to claim 9, wherein said widths of said supply and drain ports are chosen such, that they about correspond to a width of said channel piece.

11. Method according to any one of the preceding claims, wherein said system of capillary channels including said supply and drain channels with their respective ports are etched or micromachined or otherwise established in a planar substrate made of glass, or semiconductor materials, or a suitable polymer, or the like. (1)

claim 10 → 12. Sampling device comprising a channel (12; 22) for an electrolyte buffer and a supply

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channel (13; 23) and a drain channel (14; 24) for a sample, which each discharges into said electrolyte channel (12; 22) at a respective supply (15; 25) and a drain port (16; 26), which ports are located with respect to each other such, that a sample volume (17; 27) is geometrically defined, said supply and drain channels each being inclined to a longitudinal extension of said channel piece, and means for electrokinetically injecting a sample into said sample volume, characterized in that said source channel (13; 23) and said drain channel (14; 24), each have a resistance to flow with respect to said electrolyte buffer, which is about 5% lower than the respective resistance to flow of said electrolyte channel (13; 23).

13. Sampling device according to claim 12, wherein said supply (13; 23) and drain channel (14; 24) each has a width (w) that is at least about two times greater than a width (p) of said supply (15; 25) and drain ports (16; 26).

14. Sampling device according to claim 13, wherein said supply (15; 25) and drain ports (16; 26) of said respective supply (13; 23) and drain channels (14; 24) have a longitudinal extension (l) which corresponds at least to about said widths (p) of said supply and drain ports, and that said widths (w) are about constant along the extension (l) of said supply and drain ports.

15. Sampling device according to claim 14, wherein said widths (p) of said supply (15; 25) and drain ports (16; 26) about correspond to a width (b) of said channel piece (12; 22).

16. Sampling device according to claim 15, wherein said channels have a depth of from about 0.1 μm to about 100 μm .

claim 17 → 17. Sampling device according to any one of claims 12 to 16, wherein said supply port (15; 25) and said drain port (16; 26) are spaced apart from each other a distance (d) which amounts to from about 0 μm to about 3 cm, preferably to about 3 mm.

18. Sampling device according to any one of claims 12 to 17, wherein said supply channel (13; 23) and said drain channel (14; 24), respectively, each are inclined with respect to said longitudinal extension of said channel piece an angle that amounts to from about 5 degrees to about 175, preferably to about 90 degrees and further wherein said supply channel (13; 23) and said drain channel (14; 24) extend about parallel to each other.